Even though we have no record of the damage caused to our fish fauna by the introduction into India of *Gambusia* the Public Health authorities would do well to be cautious and abandon further propagation of *Gambusia affinis affinis* (Baird & Girard) and *G. a. holbrookii* (Girard) for malaria control in India.

It may be noted that Poeciliidae, to which *Gambusia* belong, are closely related to the Cyprinodontidae of which five species, namely *Aplocheilus panchax* (Ham.), *A. lineatus* (C. & V.), *A. blocki* (Arnold), *Oryzias melastigma* (McClelland), and *Asphanius dispar* (Rüppell), are found in India, and detailed investigations conducted by Hora and Nair, Gravely, Job, John, etc. (see Hora & Mukerji 1953) have already shown that these fishes are as good as larvicidal fishes as any of the exotic species. They are perennial breeders, and *A. lineatus* is remarkable in its occurrence in all types of water such as hill-streams and reservoirs at high altitudes, and in rivers, tanks, and wells of the plains, low-lying paddy fields, swamps, estuaries, and backwaters (Chacko 1949). All these species are known to be easy to breed in the aquarium, and it is worth while trying commercial breeding of them in aquaria to make them available at a nominal cost for anti-malarial work.

ZOOLOGICAL SURVEY OF INDIA,
34, CHITTARANJAN AVENUE,
CALCUTTA-12
April 20, 1965.

A. G. K. MENON

REFERENCES

CHACKO, P. I. (1949) : Some observations on *Aplocheilus lineatus* (Cuv. & Val.) in Madras Province. *J. Bombay nat. Hist. Soc.* **48** (3) : 604-605.

HORA, S. L., & MUKERJI, D. D. (1953) : Table for the identification of Indian fresh-water fishes, with description of certain families and observations on the relative utility of the probable larvivorous fishes of India. Malaria Bureau No. 4, ed. 3. Delhi.

MYERS, G. S. (1965) : Gambusia, the fish destroyer. Tropical Fish Hobbyist : 31-32, 53-54. New Jersey, U.S.A.

24. SEXUAL BEHAVIOUR IN *LYCOSA CHAPERI* SIMON (ARACHNIDA : ARANEIDA)

(*With four text-figures*)

SYNOPSIS

Observations have been made on the sexual behaviour of *Lycosa chaperi* Simon. The act of copulation in this spider is preceded by two distinct behavioural phases, viz. precourtship and courtship. During the precourtship phase the male spider charges its intromittent (palpal)

organ with semen through a process called sperm induction. This unique process involves transferring the spermatozoa from the internal gonadial system to the palpal organ borne by the pedipalp. Sperm induction is followed by a 24-hour rest period. It is suggested that the spermatozoa undergo certain physiological changes during this period.

The courtship period in *L. chaperi* is of comparatively short duration, probably because the male and the female individuals are of similar stature. In a majority of spiders the males are much smaller than the females and thus courtship is a lengthy process. During copulation the male mounts the female from the opposite direction while she lies in a state of catalepsis. The male uses palpal organs alternately for insertion into the female genital opening. The duration of the sexual act may vary from two to forty-five minutes.

Introduction

Male spiders lack a primary intromittent organ and have developed instead at the apex of each pedipalp a secondary intromittent apparatus called the palpal organ. Prior to copulation the male spider transfers the spermatic fluid from seminal vesicles in its abdomen to the palpal organs by a process known as sperm induction. The female genital organs, located ventrally near the base of the abdomen, are specialized to receive and store the spermatozoa.

This paper records observations on sexual behaviour in *Lycosa chaperi*, which comprises four distinct phases; precourtship, courtship, precopulation, and copulation.

The observations were made in the zoological laboratories of the Panjab University, Chandigarh. The authors are grateful to Prof. G. P. Sharma, Head of the Department, for providing the necessary facilities.

Observations

Precourtship. Precourtship comprises sperm induction in the male, with no corresponding process in the female. Prior to this the males seem incapable of mating and it has been observed that *L. chaperi* males with empty palpal organs make no effort to copulate. This has also been observed by Petrunkevitch (1911) in a Theraphosid spider *Dugesiella hentzi*. Kaston (1948) mentions that 'fullness in the testes' and 'emptiness in the palpal organs' are the probable factors that stimulate sperm induction.

In *L. chaperi* sperm induction was observed in a laboratory cage that consisted of a lantern chimney placed on a petri-dish containing dung-pieces. The males, upon reaching sexual maturity show distinct signs

of restlessness and run around within the chimney. Finally, a sheet of web is constructed with one side attached to the wall of the chimney and the other to the bottom. The male then vibrates its abdomen rapidly sideways rubbing it against the web and finally depositing a spermatophore on the sheet web. The abdominal action seems to be correlated with concentration of heavy setae around the genital orifice and presumably produces a tactile stimulation, which causes ejaculation of the seminal fluid. After ejaculation, the male moves slightly backward bringing its palpi below the sheet and applies the palpal organ to the semen, presumably in order to 'suck' the fluid. Contrary to the experience of Petrunkevitch (1911) with *Dugesiella hentzi*, *L. chaperi* males are extremely sensitive to disturbances of any kind during this process.

For approximately 24 hours after sperm induction the males of *L. chaperi* do not attempt to mate. It is possible that during this period the spermatozoa undergo physiological changes in the palpal organ.

Courtship. Montgomery (1903, 1910) mentions the importance of secondary sexual characters in courtship. In *L. chaperi* there is no marked development of secondary sexual characters apart from the conspicuously black tarsi and metatarsi of the front pair of legs.

The courtship period is very short, presumably because the two sexes are of equal strength and build. Petrunkevitch (1911) and Kaston (1936) mention that courtship in spiders exploits the senses most highly developed in them. Kaston (1936) remarks that either or both the senses of sight and touch are involved in the courtship of certain vagabond spiders. It appears that both sight and touch are involved in the courtship of *L. chaperi*. The sense of touch seems to be of greater importance, because males were noticed to attempt mating upon random contact with females.

Savory (1928) and Gertsch (1949) have reported the use of signals through the silken threads of the web during courtship in some spiders. Gering (1953) also observed similar behaviour in three species of *Agelena*. As, however, *L. chaperi* is a ground-dweller, the females do not always spin a web and the approach of the male to the female is direct.

When placed together in a cage, both the male and the female remain inactive for a few minutes. Courtship begins only when the male accidentally comes across the female. Immediately, the male poses with raised body and extended pedipalps (Fig. 1). Slowly he advances towards the female with palpi and front legs elevated and the latter directed towards her (Fig. 2). The metatarsi and the tarsi of the front legs tremble violently during the advance, as if performing a dance. When he reaches close enough to her there is an interplay of the front legs of both. She tries to drive him away, but he overpowers her and climbs on her (Fig. 3).

Precopulation. During precopulation the male establishes contact with the female after proper positioning. The female meanwhile remains passive in a state of catalepsy, involving the entire body especially the

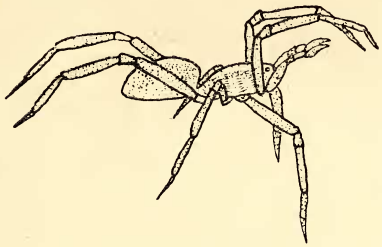

Fig. 1. Position of a male on contact with a female

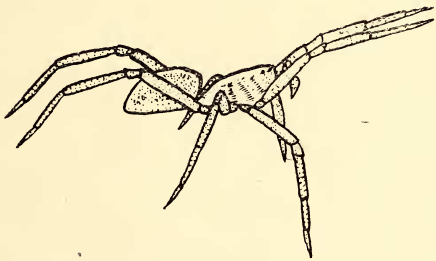

Fig. 2. Posture of a male while advancing towards a female

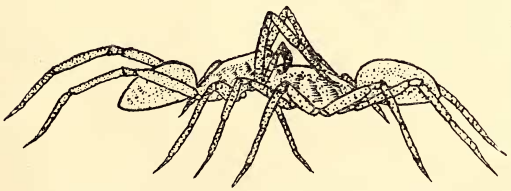

Fig. 3. A male and female in readiness for copulation

legs. As soon as the male establishes contact the female drops to the substratum, with the first and the second pair of legs pointing forward and third and fourth pair pointing backward. The male lifts her body and turns her abdomen slightly with his first pair of legs. After adjust-

ment of the body position his body lies at an angle of about 45° with the long axis of her body (Fig. 4).

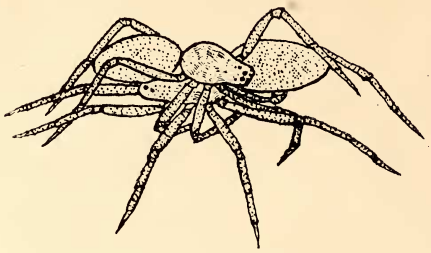

Fig. 4. A male and a female engaged in copulation

There is no resting stage following the positioning phase and copulation follows immediately.

Copulation. In spiders copulation may be defined as the physical contact between the palpal organs of the male and the epigynum of the female.

In *L. chaperi*, immediately after the positioning phase, the male begins to tap the epigynum of the female with his palpi. The number of attempts made before inserting the palpal organ into the female opening vary. Finally, contact is established by a slight twist of the palpus and further adjustment in the body position (Fig. 4). The palpal organ fits into the furrow-sac at the anterior end of the epigynal opening. The furrow-sac can be compared with the coupling cavity in Agelenid spiders (Gering 1953). The right and left palpal organs are used alternately for insertion into the female organ. During this act the male jerks his abdomen and hind legs vigorously and taps the abdomen of the female with his forelegs. The duration of copulation in *L. chaperi* may vary from two to forty-five minutes.

A single female has been observed to mate with as many as 10 males on the same day, but a male after one mating avoids contact with females.

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LITERATURE CITED

BRISTOWE, W. S., & LOCKET, G. H. (1926): The courtship of British Lycosid spiders, and its probable significance. *Proc. zool. Soc. London* **2**: 317-347.

GERING, R. L. (1953): Structure and function of the genitalia in some American Agelenid spiders. *Smithsonian Misc. Coll.* **121** (4): 1-84.

GERTSCH, W. J. (1949): American spiders. New York.

KASTON, B. J. (1936): The senses involved in the courtship of some vagabond spiders. *Ent. Amer.*, N. S., **16** (2): 97-167.

——— (1948). Spiders of Connecticut State. *Geol. nat. Hist. Surv. Bull.* **70**: 1-874.

MONTGOMERY, T. H., Jr. (1903): Studies on the habits of spiders, particularly those of the mating period. *Proc. Acad. Sci. Philadelphia* **55**: 59-149.

——— (1910): Significance of the courtship and secondary sexual characters of araneads. *Amer. Nat.* **44**: 151-177.

PETRUNKEVITCH, A. (1911): Sense of sight, courtship and mating in *Dugesiella hentzi* (Girard), a theraphosid spider from Texas. *Zool. Jahrb., Anat.* **31**: 355-376.

SAVORY, T. H. (1928): The biology of spiders. Sidgwick and Jackson, London.

25. A NEW SPECIES OF *EPICROSEJUS* BERLESE (ACARINA: EPICROSEJIDAE) FROM SITALA IN WEST BENGAL

(*With two plates containing ten figures*)

The genus *epicrosejus* Berlese is, at present, represented by five species: *angelioides* Berlese (1904) from Java, *E. seioides* Berlese (1910) from Java, Tahiti (Berlese 1918), Marquesas Islands (Vitzthum 1935), *E. scutatus* Berlese (1923) from Sumatra; *E. zimmermani* Trägårdh (1953) from Mangareva Islands, *E. porosus* Domrow (1956) from Green Ant Islands. The species, described below from India, is the second record of the genus from the Indian Sub-Region.

Epicrosejus abinashi sp. nov.

Female. The dorsum (length 0·684 mm.; width 0·540-0·558 mm.) is partly covered by the anterior, median, and posterior shields. All dorsal setae are pilose. The anterior dorsal shield is triangular, a little wider than long, and bears about thirty-one pairs of setae. The anterior shield is surrounded by inter-scutal membrane except at the anterior end (Plate I, Fig. 1). The median dorsal shield is somewhat rectangular in shape and bears twelve pairs of setae (omitting the setae on the 'cuneiform areas'). The anterior and posterior 'cuneiform areas' are provided with five and two setae each, respectively. The median shield is entirely surrounded by inter-scutal membrane. The posterior dorsal shield consists of two shields with a median longitudinal groove bearing no setae, which is continuous with a similar ventral strip behind the anus. Each of the two posterior shields bears ten to eleven setae. The